SPECIFICATION

Stationary Armature Machine

Cross Reference to Related Applications

3,870,914 03/1975 Walker, Alan 310/219

4,573,001 02/1986 Lin, Banchien 318/695

Background of Invention

[0001] Conventional Brush Type DC Electric Motors have been used for many years in power tools, electric scooters & vehicles, appliances and other assorted machinery. The main parts are comprised of an armature, field structure, yoke or housing and brush rigging. The armature being the rotating part of the motor consists of a laminated steel core having slots as a means for holding coils of wire electrically connected to a commutator affixed to a common shaft. Electrical current from a power source flows through stationary magnetic field coils and brushes affixed to a housing and through armature windings affixed to a rotor as a means for generating a rotating magnetic field magnetic wave that drives the rotor. This arrangement generates a large amount of heat at the center of the motor having limited means for heat abatement through the air gap, field structure and housing such that direct current brush type motors are much larger than ac motors (and BLDC) of the same power rating. The armature and field structure of conventional brush type dc machines are connected electrically in series, shunt, compound and permanent magnet configurations. Brushless dc (BLDC) motors having a rotating field and stator electrically connected to a multiphase electronic inverter as a means for electronic

commutation inducing a rotating magnetic field that drives said rotor. BLDC motors having a stator affixed to said housing for increase thermal abatement operates more efficiently using dc power inverted into ac power by a multi-phase electronic inverter.

Summary of Invention

[0002] The Stationary Armature Machine (SAM) has a stationary armature similar to the BLDC motor, and a stationary commutator affixed to the frame or housing for increased heat abatement. The concept behind SAM is simple: Reverse the physical position of the armature and field structure relative to the other by attaching the armature (and commutator) to the housing and the field structure (and brush assembly) to the shaft in a manner similar to BLDC motors. By making the armature (and commutator) stationary, the current carrying conductors can be made much larger as a means for increasing current carrying capacity at low voltages. Because SAM's armature coils are stationary, they are unaffected by centrifugal forces generated by the rotor's high rotating velocities. Heat generated by the armature is easily abated through the housing increasing its ability to transform electrical energy into mechanical energy efficiently. Hybrid vehicles and battery powered household /garden appliances are becoming more assessable with the advent of high energy permanent magnets, lithium ion/NiMH battery technology and high power multiphase inverters. Conventional DC brush type motors are unable to meet the demands of hybrid vehicles and appliances that required large amounts of power and operate at high rotating speeds such as leaf blowers and upright vacuum cleaners because of size, volume or weight constraints. Conventional low voltage high current dc motor armatures require large conductors that are subjected to tremendous centrifugal forces generated by the high rotating velocities. The rotating armature must be large enough to dissipate heat generated by

high currents increasing the overall size relative to Brushless dc motors (BLDC) and Controlled Slip Induction motors (IM). BLDC and IM motors use a "stationary armature" (stator) that requires an external means of excitation such as a dc to ac multiphase (electronic) inverter at great expense. By comparison: (1) SAM does not require closed loop feedback for rotor positioning such as resolvers, encoders or hall-effect sensors; (2) Develops very high starting torque; (3) Low rotor Inductance and inertia when compared to conventional dc motors. SAM uses a unique brush cooling technique to reduce brush/commutator wear and uses a stationary armature as a means for increased power output, improved thermal abatement and reduced size similar to the BLDG motor. SAM, unlike BLDC and IM's uses a mechanical rotating brush and stationary commutator as a means for excitation instead of an external multiphase inverter increasing its cost effectiveness. Battery powered high output (1000 watts) upright vacuum cleaners and leaf blowers powered by SAM take advantage of its stationary armature and large current carrying conductors to keep the overall size comparable to that of BLDC technology. Applications include: 1) Power tools & appliances (120 vac & dc battery powered)- up to 1500 watts; 2) Electric scooters & vehicles (battery powered) up to 200 Kilowatts; 3) Uninterruptible Power Supply (UPS) prime mover up to 2,000 Kilowatts; 4) Traction drives for heavy machinery up to 20,000 Kilowatts; 5) Power generators & motors up to 60,000 kilowatts and motor / generator combinations for use in hybrid vehicles up to 500 Kilowatts.

Brief Description of Drawings

[0003] Figure 1 shows the front view of the rotating brush assembly in a 2-pole configuration. Figure 2 shows the front view of the stationary commutator, slip rings and rotating brush assembly. Figure 3 shows the front view of the rotating brush assembly in a 4-pole configuration. Figure 4 shows the side view of the stationary armature machine in a

shunt wound configuration. Figure 5 shows the side view of the stationary armature machine in a series wound configuration. Figure 6 shows the front view of the internal brush and stationary commutator detail without counterweights. Figure 7 shows the front view of the internal brush and stationary commutator detail with counterweights. Figure 8 shows the front view of the radial stationary commutator and brush assembly. Figure 9 shows the front view of the external brush assembly with counterweights. Figure 10 shows the side view of the stationary armature machine in a permanent magnet configuration. Figure 11 shows the side view of the stationary armature machine in a separately excited configuration. Figures 12 through 15 show schematic representations of the series wound, shunt wound, permanent magnet and separated excited machines.

Detailed Description

[0004] Figure 1 shows the front view of a 2-pole rotating brush assembly as a means for conducting electric current from a power supply to the armature windings and field coils. Figure 1-1 shows the front view of the rotating brush assembly housing capable of providing physical support and electrical isolation of the attached components. Figure 1-2 shows a negative polarity copper brush holder attached to figure 1-1 as a means for guiding said brush and providing additional electric current shunting capacity. Figure 1-3 shows a positive polarity copper brush holder as a means for guiding said brush and providing additional electric current shunting capacity.

[0005] Figure 1-4 shows a spring as a means for keeping said brush in contact with said commutator. Figure 1-5 shows the fulcrum of the brush keeper as a means for supporting said brush keeper and as means for providing a moment opposite that applied from centrifugal forces acting on said brush. Figure 1-6 shows the counter weight portion of